



Khronos and the OpenCL Standard

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Who is the Khronos Group?

- **Industry consortium creating open API standards**
 - By the industry, for the industry - founded nine years ago - any company welcome to join
- **Enabling software to leverage silicon**
 - Low-level graphics, media and compute acceleration APIs
- **Strong commercial focus**
 - Enabling members and the wider industry to grow market opportunities
- **Commitment to royalty-free standards**
 - Making money from enabled products – not from the standards themselves

Silicon
Community







KHRONOS GROUP

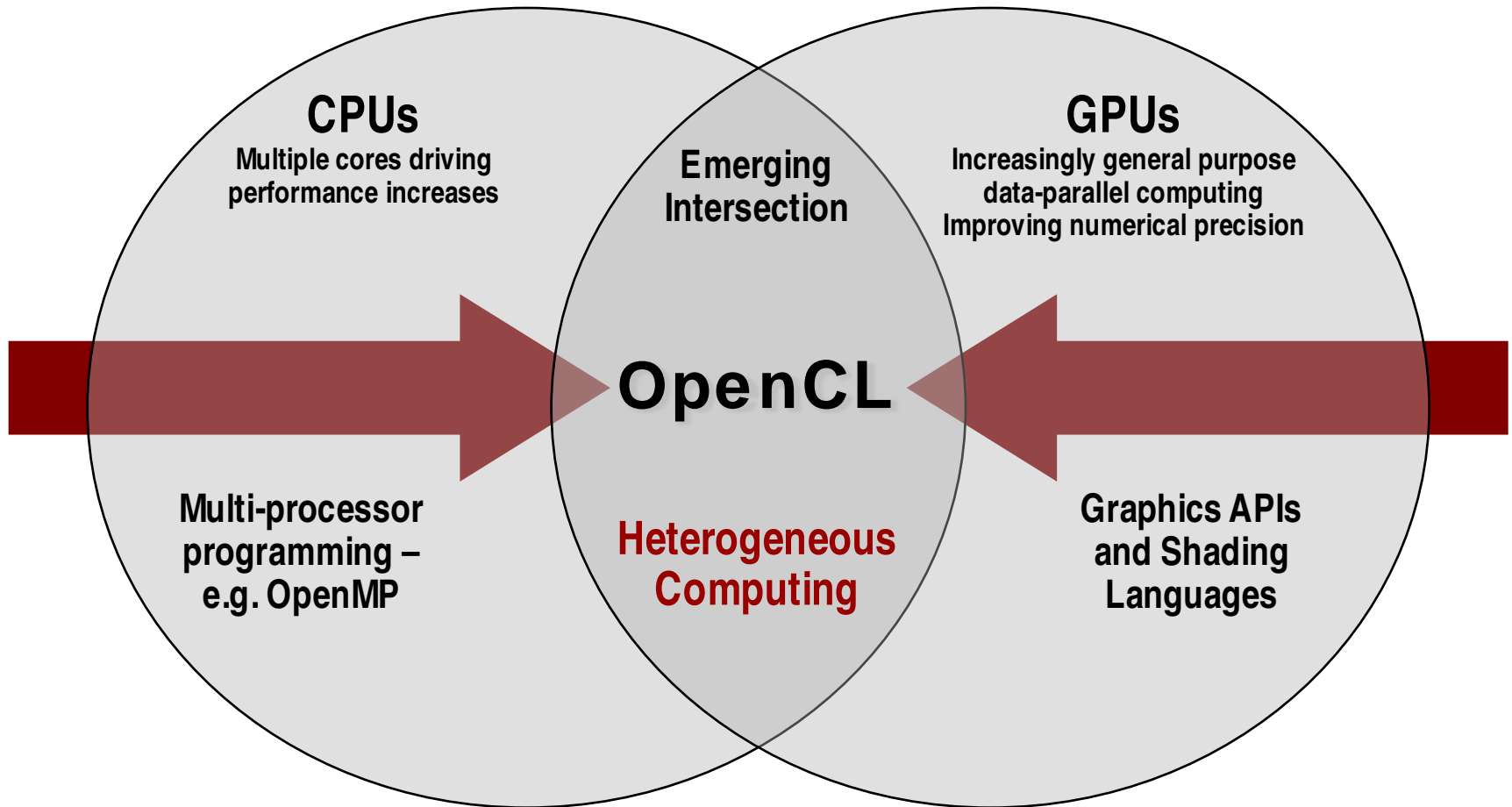
Over 100 companies creating
authoring and acceleration standards

Board of Promoters





Processor Parallelism



OpenCL Commercial Objectives

- **Grow the market for parallel computing**
 - Royalty-free, open standard for vendors of systems, silicon, middleware, tools and applications
- **Enable developers to easily exploit parallel computation**
 - Unified programming model for CPUs, GPUs, Cell, DSP and other processors in a system
 - Achieve dramatic speedups for computationally intensive applications
- **Support a diversity of applications**
 - From embedded and mobile software through consumer applications to HPC solutions
- **Provide wide application portability**
 - HPC servers, desktop systems and handheld devices
- **Create a foundation layer for a parallel computing ecosystem**
 - Close-to-the-metal interface to encourage middleware and applications
- **Rapid market deployment**
 - OpenCL 1.0 designed to run on *current* generations of GPU hardware for fast roll-out
 - THEN expand specification to inspire future silicon capabilities

OpenCL Working Group

- **Diverse industry participation**
 - Processor vendors, system OEMs, middleware vendors, application developers
- **Many industry-leading experts involved in OpenCL's design**
 - A healthy diversity of industry perspectives
- **Apple made initial proposal and is very active in the working group**
 - Serving as specification editor



OpenCL 1.0 Embedded Profile

- **Will enable OpenCL on mobile and embedded silicon**
 - Relaxes some data type and precision requirements
 - Avoids the need for a separate “ES” specification
- **Khronos mobile API ecosystem defines mixed compute, imaging/graphics**
 - Enabling advanced applications e.g. augmented reality
- **OpenCL will enable parallel computing in new market areas**
 - E.g. mobile phones, automotive, avionics



A GPS phone processes images to recognize buildings and landmarks and uses the internet to supply relevant data

OpenCL / OpenGL Interoperability

- **OpenCL can efficiently share resources with OpenGL**
 - Applications use the APIs that best fit their problem domain
- **Data is shared, not copied**
 - Textures, Buffer Objects and Renderbuffers
- **Applications can select compute device(s) to run OpenGL and OpenCL**
 - Efficient queuing of OpenCL and OpenGL commands into the hardware
 - Flexible scheduling and synchronization
 - Works on single GPU and multi-GPU systems
- **OpenCL objects are created from OpenGL objects**
 - `clCreateFromGLBuffer()`, `clCreateFromGLTexture2D()`, `clCreateFromGLRenderbuffer()`

The Khronos API Ecosystem

Desktop 3D
Ecosystem

COLLADA
3D Asset Interchange
Format

OpenGL
Cross platform desktop 3D

Parallel computing and
visualization in scientific and
consumer applications

OpenCL
Heterogeneous
Parallel Computing

Hundreds of man years
invested by industry experts
in coordinated ecosystem

Streamlined APIs for mobile and
embedded graphics, media and
compute acceleration

OpenCL – at the center of an
emerging visual computing
ecosystem with 3D, video
and image processing on
desktop, embedded and
mobile systems

OpenMAX
Streaming Media and
Image Processing

OpenGL|ES
Embedded 3D

OpenVG
Vector 2D

OpenSL|ES
Enhanced Audio

EGD
Surface and
synch abstraction

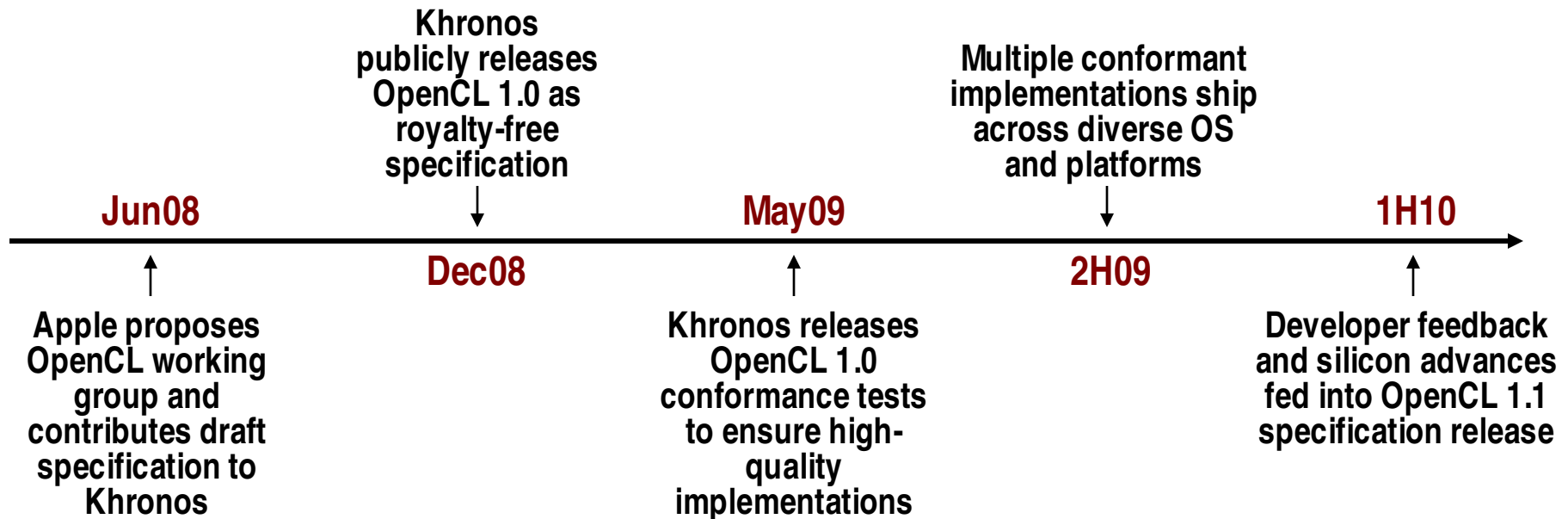
Umbrella specifications define
coherent acceleration stacks for
mobile application portability

OpenKOGS
Integrated Mixed-media Stack

OpenKODE
Mobile OS Abstraction

OpenCL Timeline

- **Six months from proposal to released OpenCL 1.0 specification**
 - Due to a strong initial proposal and a shared commercial incentive to work quickly
- **Apple's Mac OS X Snow Leopard will include OpenCL**
 - Improving speed and responsiveness for a wide spectrum of applications



OpenCL Resources

- **OpenCL Registry**

 - www.khronos.org/registry/cl/

- **OpenCL Reference Card**

 - PDF version www.khronos.org/files/ocl-quick-reference-card.pdf
 - Pick up your physical copy today!
 - Man pages coming soon!

- **OpenCL Developer Forums**

 - www.khronos.org/message_boards/
 - Give us your feedback!

- **Extensive Conformance Test Suite**

 - Full source access for small fee
 - Peer review of results by OpenCL working group
 - Passing implementations licensed to use the OpenCL trademark



The Industry Impact of OpenCL

- **For software developers**
 - Royalty free API for writing parallel programs that will run on many devices
 - A wider choice of parallel compute tools, libraries and middleware
- **For silicon vendors and OEMs**
 - A wide range of software and tools to drive hardware demand
 - OpenCL Conformance Test Suite available
- **.. and most importantly - end-users will benefit**
 - A wide range of innovative parallel computing applications
- **If this is relevant to your company
please join Khronos and get involved!**

